

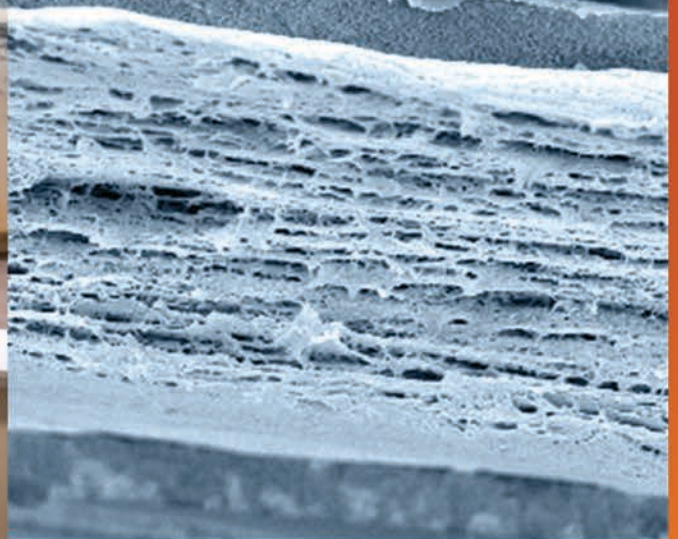


ENTEK

US • UK
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LITHIUM SEPARATOR PRODUCT PORTFOLIO



ENTEK Membranes LLC offers a broad portfolio of separators for Li-primary, Li-metal, and Li-ion battery manufacturers, as well as a customised separator solutions service.

ENTEK manufactures biaxially oriented, polyethylene separators using a unique wet process. These separators are largely composed of ultrahigh molecular weight polyethylene (UHMWPE), which provides outstanding melt integrity. They are manufactured commercially in thicknesses ranging from 5-20 μm with porosities from 40-65%. Where battery manufacturers demand ultra-low impedance, ENTEK offers a ceramic-filled separator.

Our EP, EPH, and EPX series of separators are manufactured using unique processing technology to achieve a broad range of desired performance.

EP - traditional separator used in Li primary and Li-ion cells

EPH - separator choice for higher power applications

EPX - base material used for coated separators

CF - ceramic filled separator for rechargeable Li metal batteries

EP

Property	Units		5EP	7EP	9EP	12EP	16EP	20EP
Nominal Thickness	μm		5	7	9	12	16	20
Basis Weight	g/m^2		2.9	4.0	5.0	6.5	9.0	11.0
Nominal Porosity	%		44	44	44	44	44	44
Air Permeability	$\text{sec}/100\text{ ml}$		110	105	140	145	245	275
Puncture Resistance	g		170	215	260	300	455	540
Tensile Strength	kg/cm^2	MD	≥ 1500	≥ 1200	≥ 1300	≥ 1000	≥ 1000	≥ 1100
		TD	≥ 1100	≥ 700	≥ 900	≥ 900	≥ 900	≥ 900
Tensile Elongation	%	MD	30	40	55	115	70	90
		TD	140	165	280	280	250	245
Thermal Shrinkage @120C, 1 hr	%	MD	10.0	10.0	10.0	11.0	11.0	11.0
		TD	1.0	3.5	4.5	2.0	2.0	3.0

EPH

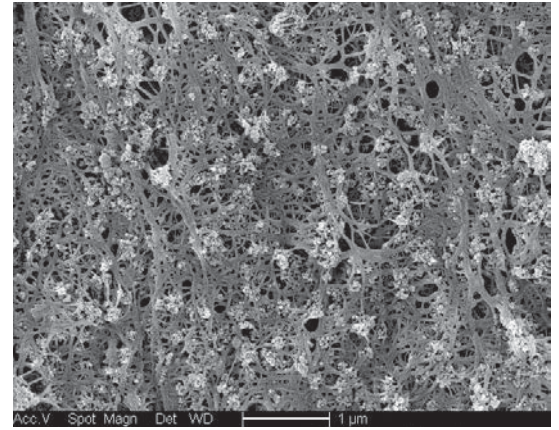
Property	Units		9EPH	12EPH	16EPH
Nominal Thickness	μm		9	12	16
Basis Weight	g/m^2		4.6	6.2	8.1
Nominal Porosity	%		48	48	48
Air Permeability	$\text{sec}/100\text{ ml}$		75	95	125
Puncture Resistance	g		255	315	375
Tensile Strength	kg/cm^2	MD	≥ 1100	≥ 1000	≥ 900
		TD	≥ 800	≥ 800	≥ 700
Tensile Elongation	%	MD	68	68	81
		TD	249	289	284
Thermal Shrinkage @120C, 1 hr	%	MD	9.5	7.5	9.0
		TD	4.0	2.0	3.5

EPX

Property	Units		9EPX	12EPX
Nominal Thickness	μm		9	12
Basis Weight	g/m^2		4	5.5
Nominal Porosity	%		54	54
Air Permeability	$\text{sec}/100\text{ ml}$		45	70
Puncture Resistance	g		260	305
Tensile Strength	kg/cm^2	MD	≥ 1100	≥ 1000
		TD	≥ 700	≥ 700
Tensile Elongation	%	MD	44	60
		TD	150	260
Thermal Shrinkage @120C, 1 hr	%	MD	12.0	10.0
		TD	9.0	5.5

CF

Property	Units		9CF	12CF
Nominal Thickness	μm		9	12
Basis Weight	g/m ²		4.2	5.3
Nominal Porosity	%		65	65
Air Permeability	sec/100 ml		35	45
Puncture Resistance	g		265	325
Tensile Strength	kg/cm ²	MD	≥ 1000	≥ 1000
		TD	≥ 800	≥ 800
Tensile Elongation	%	MD	50	45
		TD	150	175
Thermal Shrinkage @120C, 1 hr	%	MD	13.0	14.0
		TD	8.0	9.0



Ceramic filler distributed throughout the polymer matrix provides excellent wettability and ultra-low impedance.

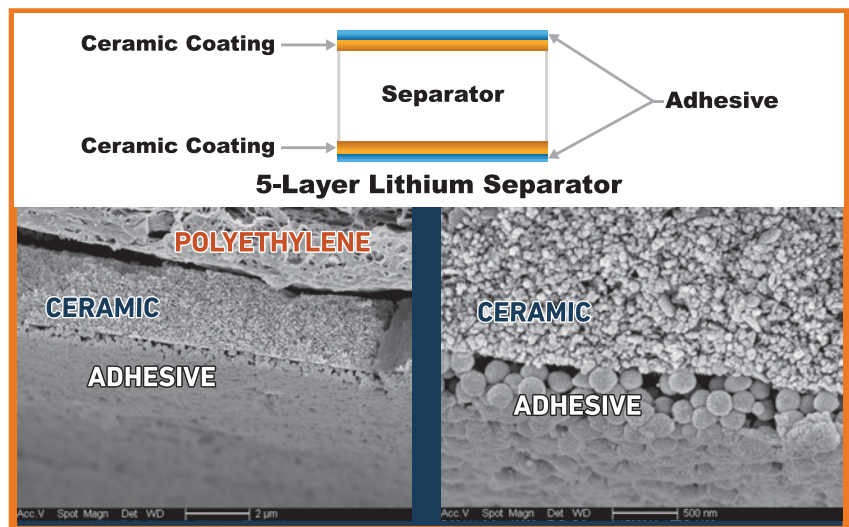
Coatings for Safety and Lamination

ENTEK manufactures a variety of coated separators that include single-side, double-side, and multilayer coatings on any of the above base separators.

- PVDF-coated separators for laminated cells
- Alumina-coated separators with excellent high temperature dimensional stability based upon ENTEK's patented nanoparticle technology (US Patent # 9,847,519)
- 5-layer separator with outer adhesive functional layers and alumina-coated polyolefin base separator for laminated cells often used in xEV batteries

5-Layer Separators for Laminated Pouch Cells

Scan the QR Code to learn more about ENTEK's coating technology



This brochure is only intended to show typical properties of ENTEK lithium separators. We encourage purchasers to conduct tests to determine final suitability for their specific end uses.

LITHIUM-ION BATTERY SEPARATORS

As part of ENTEK Technology Holdings, ENTEK Membranes benefits through vertical integration of its parent's plastics equipment processing expertise

- ENTEK Membranes LLC offers a broad portfolio of separators for Li-ion, Li-metal and Li-primary applications as well as customized separator solutions.
- ENTEK is the only 'wet-process' manufacturer of biaxially oriented, polyethylene separators in the USA.

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